GSAS v3.4 Release Notes

Introduction

GSAS 3.4 is a semi-major release which resolves 35 software change requests and/or software problem reports. Major new functionality includes a fix for the 19m range offset, ability to correctly handle GPS resets (ie: no more backwards time), better IST/LRS alignment, corrected flag words, maximum peak waveform processing, and more optimum L1A atmosphere processing. A brief summary of the major changes follows:

- The 19m range offset induced by a bad range offset has been corrected.
- IST/LRS aligment has been improved by reworking the alignment algorithm. Additionally, known problems with the instrument data for the IST coi and LRS timetag have been handled within the code. New flags have been added to the GLA04 LRS and IST products to indicate what corrections have been made and the sucess of the alignment process.
- The spacecraft GPS resets were causing problems with GSAS time alignment. In some cases, this resulted in inconsistent or reversed timing information. More sanity checks have been added to the L0 processing to prevent these inconsistencies. Additionally, abackwards-time check was implemented to ensure that no time reversals occur on the output products.
- Several flag words were encoded/decoded incorrectly. The problem with the waveform quality flags requires that V3.4 use only that data which have been processed with V3.4.
- The ice sheet/sea ice/ocean elevations are now determined by using the maximum peak instead of the last peak of the waveforms.
- The co-elevation and beam azimuth have been added to the level 1b and higher data products. These are the "direction of the incident laser pulse at the illuminated spot on the surface, with respect to a topocentric coordinate system defined by the zenith direction at the spot". This laser direction in the topocentric system can be expressed in terms of a co-elevation angle and an azimuth. The co-elevation gives the angle between the spot zenith direction and the laser direction. The co-elevation is closely equal to the off-nadir angle at the spacecraft for small angles. This azimuth and co-elevation would be reported by an observer illuminated by the GLAS laser and the observer would give this azimuth and co-elevation as the direction from which the pulse came.
- The 1064 channel droop correction algorithm was enhanced to improve atmosphere images.

Release Information

The ClearCase label for this release is RELEASE_3.4.

The release date is March 27, 2003.

All internal version numbers have been updated to “V3.4 March 2003."

This should be verified during operation by checking the version information in the appropriate ANC06 files.

SMDS Impact

The distribution tarfile is on glasdev.wff.nasa.gov at the following location:

```
/glasdev1/v3/dist/gsas_V3.4.tar.Z.
```

New versions of ALL the ANC07 data files are required:

New versions of ALL the ANC45 and ANC46 data files are required.

A new version of the ANC33 file is required and will be provided by ISF.

A new input file (ANC41) is required for GLAS_Alt (both Elevations and Waveforms) and GLAS_Atm. This will change the planners for GLAS_Alt Elevations, GLAS_Alt Waveforms, and GLAS_Atm.

All data must be reprocessed starting with GLA00 due to flag changes and the errors induced by the GSP resets. Again, NO pre-GSAS 3.4 data should be used with GSAS 3.4 processing.

All libraries and binaries should be recompiled using the top-level Makefile. The newly-created versions should be installed within the testbed (pending CCB release for operations).

Product Changes

No product sizes were changed.

The following product content changes were made:

- GLA01: i_ADdetOutGn units changed from unitless to counts.
- GLA01: i_gainSet1064 units changed from unitless to counts.
- GLA02: i_et_StartTemp changed from i2b to i1b, scale changed to 1.0d0.
- GLA02: i_et_StopTemp changed from i2b to i1b, scale changed to 1.0d0. Position shifted to offset 26593.
- GLA02: i_et_TempStep changed from i2b to i1b, scale changed to 1.0d0. Position shifted to offset 26594.
- GLA02: i_et_spares (3 bytes) was added to pad the product to previous size. Position starts at offset 56595.
- GLA03: i_ct_prail_v min/max changed to -10000, 20000.
- GLA03: i_ADdetOutGn name changed to i_ADdetOutGn_v.
- GLA03: i_et_StartTemp scale changed to 1.0.
- GLA03: i_et_StopTemp scale changed to 1.0.
- GLA03: i_et_TempStep scale changed to 1.0.

- GLA04-02: i_lrs_tspare1 replaced by i_lrs_flag.
- GLA04-04: i_ist_tspare2 replaced by i_ist_flag.
- GLA05: description updated for i_gval_tx.
- GLA05: description updated for i_gval_rcv.

The MSB/LSB is more clearly defined in the PDF flag descriptions. Additionally, changes in the PDF flag descriptions were made for the following flags:

```
i_WFqual
i_APID_AvFlg
i_lrs_flag (new)
i_ist_flag (new)
```

The latest product formats/descriptions will be available at http://glas.wff.nasa.gov/v34_products/.

Detailed Change Notes

CR0000097 : Calculate the Sun Position and Beam Co-Elevation
CR0000192 : Calculate sun angle etc in the elevation manager
CR0000193 : Calculate sun angle etc in the ATM manager
CR0000194 : Calculate sun angle etc in the waveform manager

Now filling Sun Angle, Beam co-elevation, and azimuth in GLA05, GLA06, GLA07, and GLA12-15. See 'Introduction' for more information.

PR0000107 : QAP expected records statistic may be wrong.

Rectified on branches pr107 and wpr107. For QAP01 and QAP02, the file start and stop times were fed in through the calling sequences (as needed) and are used to present the start and stop times.

PR0000146 : QAP Status Compute sometimes crashed with SIGFPE.

Code changes in QAP01 module made as per recommendation, on branch wcr146. The solution required simplifying some of the internal code structure.

CR0000157 : GLA04-04 IST data has bad center of integration

SRS team suggest that we use the IST data that has bad COI and bad time tag.

On IST COI: If COI is < -0.120 seconds then use the previous COI (or if first COI less then -0.120 sec use nearest good COI) that is > -0.120 seconds

On IST time tag: If IST time tag > 1 then use the fractional part. Align to vctw in same manner (use 0.8, 0.9,.. to previous vtcw then shift to current when time tag rolls back to 0.0xx)

Additionally, add a flag byte per sample. 1 bit to tell we faked COI, 1 bit to tell we faked time tag, 1 bit to say no alignment sample found.

Fixed this as requested. Also added flag to LRS data indicating missed record alignments and missed frame alignments.

PR0000160 : Wrong limits for GLA05 QA histograms

Three GLA05 QA parameters were changed to report data in volts rather than counts. The histogram min and max values in the QA summary record were fixed to reflect this change. (dQAMinNsSigmas,dQAMaxNsSigmas) & (dQAMinAmpSigmas,dQAMaxAmpSigmas) are now [-0.3,3.0] instead of [0,20]. (dQAMinSDevFit, dQAMaxSDevFit) is now [0,3] instead of [0,20]. .

CR0000166 : GLA02 and GLA03 are inconsistent with regards to Etalon temperatures

Instrument team recommends keeping as a 1 byte thing on GLA03 and changing to 1 byte thing on GLA02. The scale factor on both should be 1. Code was changed on branch CR0000166 so that the i_et_StartTemp, i_et_StopTemp, i_TempStep would have matching scales.

PR0000173 : ftn00 file is created when L_Alt is run with elevation

Duplicate of PR0000174.

PR0000174 : Stack error with GLA14 QAP file

Problem is a composite of two things. First is that the ElevMgr can still call routines for output of QAP even when those files are specifically selected "null" in the control file. This was fixed in the ElevMgr_mod. Second is yet another problem with a standard deviation computation, this time in module ElevQA_mod. Random fluctuations in data and/or "nonphysical" values can cause the stdev computation to try to take SQRT of negative number. Protective code supplied. All corrections done on branch cr174.

PR0000178 : Investigate QAP03 issues

Modified L_Eng and QAP03_mod to fix the along track times, and latitude and longitude. A check was put into the calculations for apid 21 to check for unsigned which fixed the apid 21 numbers.

PR0000179 : wfqual flag is incorrect

There are problems with wfqual both in how the bits are set and in the pdf documentation in the data base. Fixed problems with not setting the noTrPulse flag in l_wfQual, and surfType.

See also 0000189, & 0000190

PR0000181 : L_Atm dies when there are missing waveform packets.

L_Atm incorrectly assumes that if one waveform packet is available, all waveform packets are available. This enables a bad value to get into d_Rng_PkRt, which eventually

causes gla02_a2p to die. Fixed the problem by changing the code in L1AMgr to check the APID_Av_Flg.

PR0000185 : anc08/anc09 time values should be referenced to file start time

Reworked internal degradations storage to save data internally in time format referenced to absolute time and not to start of file.

PR0000186 : IEEE error in e_calcslope

d_xmit_pulsWdS was not checked for invalid and was invalid. Added invalid check to other existing invalid checks.

PR0000189/PR0000190 : surfType/wfQual packs into wrong bits

The surfType flags were packed into the wrong bits. Also fixed same error in rngCorrFlg and l_wfQual.

PR0000195 : Waveforms QA arrays outside allocated boundaries

Duplicate of PR0000236.

PR0000209 : The bits for i_rngCorrFlg are being set in the wrong byte on the product

The bits for i_rngCorrFlg were being set in the wrong byte on the product. The documentation has GLAxx%i_rngCorrFlg(1:7) stored in bits 0:6 in GLAxx_prod%i_rngCorrFlg, where bit 0 is the least significant bit of GLAxx_prod%i_rngCorrFlg(2). The code in funpk_RngCorrFlg & fpk_RngCorrFlg was storing the bits in GLAxx_prod%i_rngCorrFlg(1).

CR0000218 : GPS reset can cause bad entry in the ANC32 file

On day 54 at 6:55 the GPS reset and did not output ticks for about 30 seconds. This caused an entry in the anc32 which latched the various clocks at the wrong time. As a result, output products had a backwards time increment.

Implemented a fix where the deltas of the ANC32 elements are divided by the expected increment and then compared. A bad comparision causes the ANC32 record to be flagged and unused during processing.

PR0000222 : No Fit For Transmitted Pulse

When the transmitted pulse has more than one gaussian peak, the fitting proceedure is keeping the last peak (this looks like some kind of ringing) and throwing out the peak with the maximum amplitude.

This has been fixed in W_Assess on branch pr0000179 by increasing the fitting threshold to 30% of (max_peak_amp - noise). The transmitted pulse is also not being fit when there is no received waveform (all noise - see PR0000225).

PR0000234 : Anc08 needs to use internal header file start time

Software now uses start and duration times stored internal to the file to compute time over which the degradation flags should be set. Resolution is made on branch wcr234. Also required a minor change to anc07 file to downgrade severity.

PR0000236 : Waveform assessment has Segmentation fault error on some jobs.

Fixed in WFMgr_mod. The current QA index was checked for the end of a 16 second QA record within an if-block that was visited only if there was an output QAP file specified.

CR0000239 : IST time tag has 'large' negative value

Further investigation determined that the large negative values were actually caused by a single 0 value which messed up the rollover code. The rule adopted was to delete the entire IST frame if an IST timetag had value=0. The fix was tested with the 02/23/03 data where backwards times were reported.

CR0000240 : Sanity check for backwards output times

Added time check against UTCTime, UTCTime+deltas, and sample times, as appropriate. The changes were added into WriteL1A, WriteAtm, and WriteElev for minimum impact upon other code.

CR0000244 : GLA02 1064 Droop Correction

The 1064 channel droop correction algorithm produces a range dependent signal and also magnifies the ambient signal noise causing a streaky looking image. This has been fixed in L_Atm.

CR0000250 : anc09 needs to use internal header file start time

Fixed issue with ANC09 start time (same issue as POD in PR0000234).

CR0000253 : GLAS_Alt overflows array in ElevMgr

l_wfQual flags gwi_noFit1, gwi_noFit2, gwi_noSig1, & gwi_noSig2 were not being set if the frame was bad or if the waveform was invalid.

Various places in ElevMgr check these flags & if the noSig or noFit flags were not properly set, then it crashed.

CR0000275 : ANC33 file has wrong sign for range offset.

Fixed the sign of the digitizer internal range delay in the ANC33 file. This error caused a 19m range error.

Changed the d_rDelay_digtzr to 9.5560d0. Left remaining parameters at existing values:

```
glas_osc_rate = 1.000000025000001d0
sc_osc_rate = 0.99999998864727d0
tdelay_digtzr = 0.00001511d0
```

```
plTbias = 0.0000d0
d_plRbias = 0.000002d0
tracker states = 0, 1, 2
instrument_state = 2147483647
```

CR0000287 : Change Some Values in ElevMgr to use Max Peak

Changed the following to use max_amplitude peak instead of last peak:

```
GLA06%d_isRngOff   = d_rngMaxPkS
GLA06%d_siRngOff   = d_rngMaxPkS
GLA06%d_ocRngOff   = d_rngMaxPkS
GLA12%d_IsRngLast  = d_rngLstPkS
GLA06%d_SigmaElv   = d_SDlocMaxPkS
```

In call to E_CalcSlope, used peak width of maxAmp peak.

Checked maxAmp peak sigma for GLA06%i_SurfRufslpQF, GLA13%i_SiRufQF, & GLA15%i_OcRMSqf

PR0000290 : a_4s_1064_det_mod has array problems.
PR0000289 : a_avg_prof_mod has array bounds problems.
PR0000288 : a_bscs_mod.f90 has a divide by 0 condition

All of the above fix various FPE and array overflow problems in various pieces of the upper-level atmosphere code.

PR0000292 : Remove Higher-level atmosphere output time consistency check

Due to a known error in atmosphere buffering, there are several instances where upper level atmosphere products will fail the new output time consistency check (ie: verify time does not go backwards). Since this will impact our processing, we have temprorarily removed the consistency check for the upper level products until atmosphere code can be fixed.

Changed files

```
./Makefile
./data
./data/anc07_001_01_0000.dat
./data/anc07_001_01_0004.dat
./data/anc07_001_01_0005.dat
./data/anc46_001_01_0026.dat
./src/atm_lib/vers_atm_mod.f90
./src/atmosphere/backscat/A_bscs_mod.f90
./src/atmosphere/common/A_avg_prof_mod.f90
./src/atmosphere/layers/A_4s_1064_det_mod.f90
./src/common_libs/anc_lib
./src/common_libs/anc_lib/Makefile
./src/common_libs/anc_lib/anc07_l1a_mod.f90
./src/common_libs/anc_lib/anc08_pod_mod.f90
./src/common_libs/anc_lib/anc29_index_mod.f90
./src/common_libs/anc_lib/anc41_ephim_mod.f90
./src/common_libs/anc_lib/anc46_meta_mod.f90
./src/common_libs/anc_lib/vers_anc_mod.f90
```

```
./src/common_libs/cntrl_lib/vers_cntrl_mod.f90
./src/common_libs/err_lib/vers_err_mod.f90
./src/common_libs/exec_lib
./src/common_libs/exec_lib/Makefile
./src/common_libs/exec_lib/ReadAnc_mod.f90
./src/common_libs/exec_lib/check_out_time_mod.f90
./src/common_libs/exec_lib/fCntl_mod.f90
./src/common_libs/exec_lib/vers_exec_mod.f90
./src/common_libs/file_lib/Makefile
./src/common_libs/file_lib/cksum.c
./src/common_libs/file_lib/vers_file_mod.f90
./src/common_libs/geo_lib
./src/common_libs/geo_lib/Makefile
./src/common_libs/geo_lib/vers_geo_mod.f90
./src/common_libs/math_lib/vers_math_mod.f90
./src/common_libs/platform_lib/const_l1a_mod.f90
./src/common_libs/platform_lib/vers_platform_mod.f90
./src/common_libs/prod_lib/GLA02_prod_mod.f90
./src/common_libs/prod_lib/GLA02_scal_mod.f90
./src/common_libs/prod_lib/GLA03_scal_mod.f90
./src/common_libs/prod_lib/GLA04_alg_mod.f90
./src/common_libs/prod_lib/GLA04_prod_mod.f90
./src/common_libs/prod_lib/GLA04_scal_mod.f90
./src/common_libs/prod_lib/GLA05_flags_mod.f90
./src/common_libs/prod_lib/GLA06_scal_mod.f90
./src/common_libs/prod_lib/GLA12_scal_mod.f90
./src/common_libs/prod_lib/GLA13_scal_mod.f90
./src/common_libs/prod_lib/GLA14_scal_mod.f90
./src/common_libs/prod_lib/GLA15_scal_mod.f90
./src/common_libs/prod_lib/common_flags_mod.f90
./src/common_libs/prod_lib/vers_prod_mod.f90
./src/common_libs/time_lib/vers_time_mod.f90
./src/elev_lib/vers_elev_mod.f90
./src/elevations
./src/elevations/ElevQA_mod.f90
./src/elevations/anc09_pad_mod.f90
./src/elevations/c_Beam_Sun_Ang_mod.f90
./src/elevations/c_calcsploc_mod.f90
./src/elevations/e_calcslope_mod.f90
./src/elevations/e_getsunAngle_mod.f90
./src/glas_alt/ElevMgr_mod.f90
./src/glas_alt/GLAS_Alt.f90
./src/glas_alt/WFMgr_mod.f90
./src/glas_alt/WriteElev_mod.f90
./src/glas_alt/WriteWF_mod.f90
./src/glas_atm/AtmMgr_mod.f90
./src/glas_atm/GLAS_Atm.f90
./src/glas_atm/WriteAtm_mod.f90
./src/glas_l0p/GLAS_L0proc.f90
./src/glas_l1a/GLAS_L1A.f90
./src/glas_l1a/L1AMgr_mod.f90
./src/glas_l1a/WriteL1A_mod.f90
./src/glas_meta/GLAS_Meta.f90
./src/l1a_lib/L_Atm_mod.f90
./src/l1a_lib/L_Att_mod.f90
./src/l1a_lib/L_Eng_mod.f90
./src/l1a_lib/QAP01_mod.f90
./src/l1a_lib/QAP02_mod.f90
```

```
./src/l1a_lib/QAP03_mod.f90
./src/l1a_lib/align_prap_mod.f90
./src/l1a_lib/vers_l1a_mod.f90
./src/waveforms/W_Assess/W_Assess_mod.f90
./src/waveforms/W_Common/QA_wf_mod.f90
./src/waveforms/W_FunctionalFt/W_FunctionalFt_mod.f90
./src/wf_lib/vers_wf_mod.f90
```